JÜLICH
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# Considering Integrated Safeguards and the State-Level Concept in the Development of Equipment and Techniques for Safeguards

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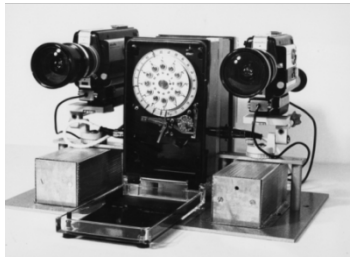
# Introduction – The Evolution of Safeguards

| | CSA | AP | IS |
|---|---|---|---|
| | 1971 * | 1997 * | >1999 |
| | INFCIRC/153 | NFCIRC/540 | -- |
| Basic principle | NMAC | extended declaration by state<br>CA | |
| Measures | Detect diversion of nucl. mat. | Verify absence of undecl. material and activities | Combination of traditional and strengthened measures |



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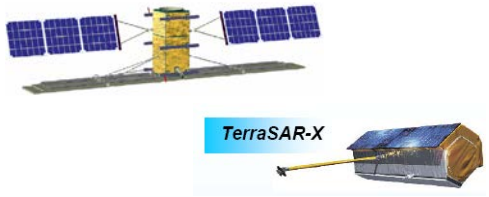



*) Year of approval by IAEA Board of Governors

# Integrated Safeguards in the EU

- Euratom Treaty → EC takes role of safeguards authority as a RSAC (INFCIRC/193)
- New Partnership Approach agreed between EC and IAEA (1992), e.g.
  - Joint inspections
  - Sharing of documents and data
  - Joint use of equipment
- Broader Conclusion drawn for all 24 NNWS with significant nuclear activities
- Introduction of IS in 2010

Changes through IS:

- Reduced timeliness goals for verification of nuclear material
- Reduced verification requirements for less sensitive types of facilities
- Principle of unpredictability

# Role of Equipment for IS Implementation – Example 1

**Short-Notice Random Inspections (SNRI) as a moment of unpredictability**

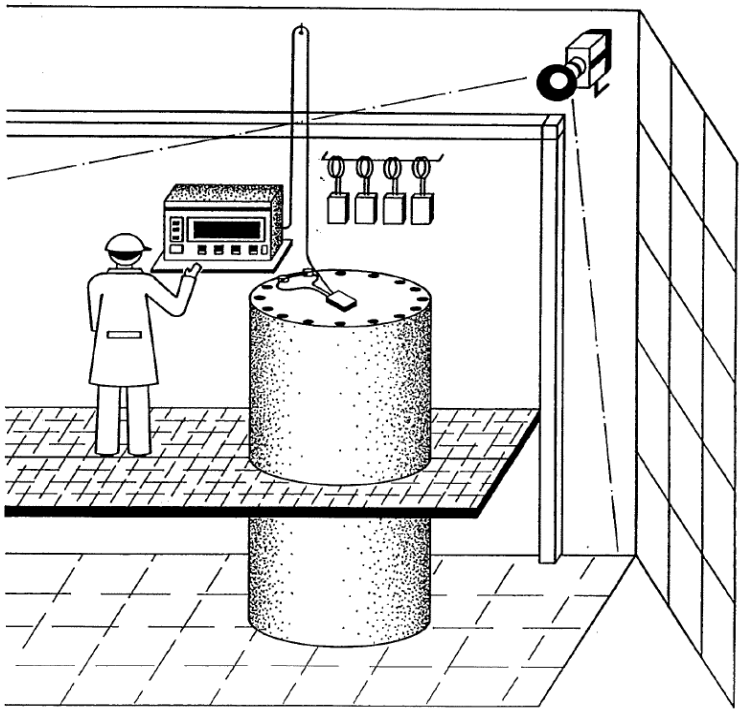
- Unannounced inspection on randomly selected site leads to difficulties
  - Joint inspection with Euratom not possible
  - Usually preparation time to arrange inspector access required
- Instead of UI, 24-48 h notice time is introduced → SNRI
- Condition: Optical surveillance to cover the notice period
- Application of Remote Data Transmission (RDT): check State-of-Health (SoH) of surveillance during notice period

# Role of Equipment for IS Implementation – Example 2

**Castor cask sealing by Euratom or operator**

- IS: Application of electr. seal on loaded cask under surveillance by EURATOM or operator
- Operator requires a confirmation, whether seal attachment procedure was successful

  → „User Terminal“ for cask-sealing
  - Step-by-step Instructions
  - Feedback to the user
  - Confirmation on successful completion of the procedure
- Application of RDT to retrieve SoH and sensor data (Seal + surveillance) prior and after sealing procedure



Configuration of „IT 90“
Source: JOPAG/06.92-PRG-232, Forschungszentrum Jülich

# Equipment Features – „Smart Sensors“

Equipment Features for IS:

- Unattended
- Autonomous
- RDT capable
- Provides State-of-Health data
- Allows data sharing for joint-use
- Data integration
- Permits delegation of tasks to the RSAC/operator

„Smart Sensors“ *:

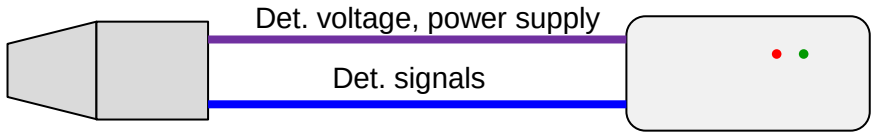
- Digital Sensors
- Digital authentication in proximity to the sensor
- Data encryption
- Local data storage, plus autonomy from external power
- Data transmission capabilities
- Tamper-indicating enclosure of sensor

→ Favourable equipment features for IS implementation

*) See also G. Neumann, K. Gaertner, B. Richter (1997): “*The Use of Smart Sensors and its Implications on Safeguards Procedures*”, Proc. 38th INMM Annual Meeting

M. Stein, et al. (2009): *„The Next Generation Surveillance System, Development Project Overview“,* Proc. 31st ESARDA Annual Meeting, Vilnius, Lithuania

# Radiation Detection Systems as „Smart Sensors“

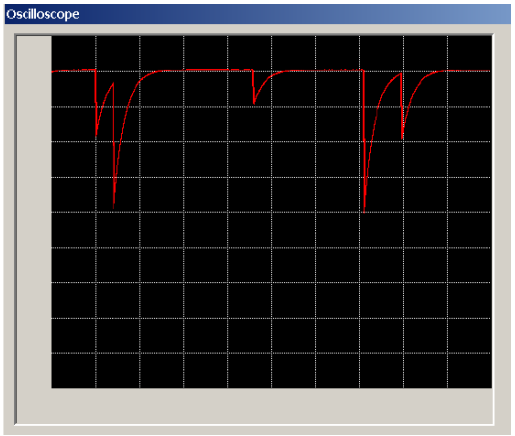



Sensor Head

Detector electronics module


e.g. Multi-channel analyzer with digital pulse processing

- Data storage on device
- Data communication
- Information on SoH:
  - Internal Temperature, Detector temperature
  - Diagnostics of analog detector signals (‚oscilliscope mode‘)
  - pre-amp supply currents
- Add encryption + authentication
- Add tamper-indicating enclosure




GBS Elektronik, “MCA-527 Digital Multi-Channel Analyzer User Manual”, http://www.gbs-elektronik.de

# Summary

Implications of Integrated Safeguards

- less effort for on-site verification
- Longer time-intervalls between inspections
- Increased importance of unattended sensors and RDT
- Reliance on IAEA/RSAC cooperation
- Benefits from smartly designed equipment
- Further improvement by integration of data from various sensors